Ovipositing of *Circulifer tenellus* Baker (Homoptera, Cicadellidae)

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In the course of experiments with leafhopper vectors of certain plant disease agents, such as viruses and mollicutelike organisms (Maramorosch, 1969), an observation was made concerning oviposition by *Circulifer tenellus* Baker, the beet leafhopper that transmits the agent of sugar beet curly top disease. Groups of 10 adult male and female leafhoppers were routinely confined to sugar beet plants in small cages, fastened to either the upper or the lower leaf surface by clip cages (Maramorosch, 1951) or by magnetically attached cages (Kaloostian, 1955). The latter were modified sometimes so as to provide adequate aeration through a cylinder made of Saran monofilament plastic screen (Fig. 1). Irrespective of the type of leaf cage used, only the upper or lower leaf surface was accessible to the feeding insects. This "limited access" feeding differed from the usual methods in which stock culture or disease agent-carrying insects are given free access to all aboveground parts of a test plant.

Frequently during the summer months gravid beet leafhopper females deposited eggs in leaf tissues while confined to beet plants in small cages. Surprisingly, eggs were deposited in such a manner that nymphs never hatched on the side on which the females were confined. Whenever the cages were attached to the upper surface of leaves (Fig. 1), the eggs were found protruding from the lower surface (Fig. 2). When insects were placed on the lower leaf surface, their eggs were seen on the upper surface only (Fig. 3). The number of eggs found on the lower surfaces seemed to exceed the number deposited on the upper ones, but no statistical analysis was made to ascertain whether the difference was significant.

In a few instances leaf cages containing gravid females were left attached for as long as three to five weeks without disturbing the insects. In such instances nymphs that hatched from deposited eggs began to feed on the side opposite the caged adults. Some nymphs managed to squeeze through occasional narrow gaps between the leaf surface and the bottom part of the clip cage and they would occasionally appear on other parts of a test plant. Once free to move, such first and second instar nymphs would become potential sources of greenhouse contamination.

To prevent the escape of progeny nymphs and accidental greenhouse contamination, exposed leaves were marked by punched holes. After the

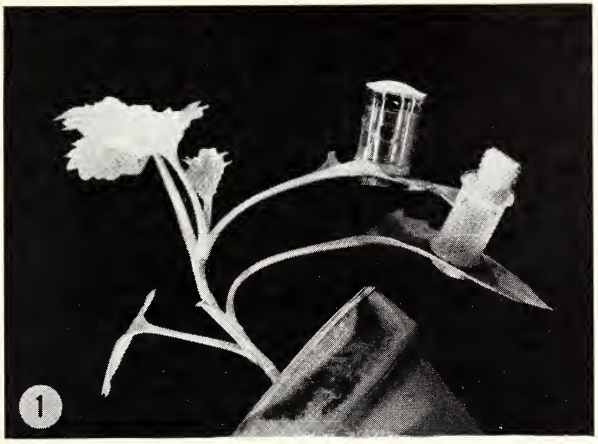

FIG. 1. Two insect cages, magnetically attached to leaves. Upper (left) cage is of cellulose nitrate tubing, with a Saran monofilament screen on top. Lower (right) cage is made entirely of Saran monofilament screen, with cotton plug on top to insert insects. The bottom of each cage, resting on the leaf surface, is covered by a 15 dernier nylon screen.

FIG. 2. When caged insects were confined to the upper leaf surface, eggs were protruding from the lower surface.

FIG. 3. Single leafhopper egg, protruding from upper surface of a leaf; in this instance a gravid female was confined to the lower surface of the leaf.

removal of insect cages, usually within the first ten days of test feeding, the marked leaf portion was cut off and destroyed before first instar nymphs began to hatch. Whenever gravid females had to be confined to plants in leaf cages for periods exceeding three to four days, the cages were transferred from one area to another, or from leaf to leaf, and the exposed portion containing deposited eggs was excised and discarded. This procedure did not prevent successful inoculation of plants with viruses or mollicutelike agents (Maramorosch et al., 1962) since these disease agents were rapidly transported through phloem elements to other parts of the plant.

A probable explanation of the observed hatching of nymphs on the leaf surface opposite that of female confinement was the length of the ovipositor and the depth of penetration (Müller, 1942). It seems less likely, though not inconceivable, to assume that the females were making a deliberate attempt to place their eggs in such a manner as to ensure that their progeny would not hatch within the limited area of their own "prison confinement." The first, purely mechanistic, explanation seems the more plausible.

Forcing oviposition by means of leaf cages within a limited area of a leaf has also been advantageous for the rapid collection of leafhopper eggs, used as the source of embryonic material for insect tissue culture (Hirumi and Maramorosch, 1964).

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